



Sea level budget in the Arctic during the satellite altimetry era

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Studying sea level variations in the Arctic region is challenging because of data scarcity. Here we present results of the sea level budget in the Arctic (up to 82°N) during the altimetry era. We first investigate closure of the sea level budget since 2002 using altimetry data from Envisat and Cryosat for estimating sea level, temperature and salinity data from the ORAP5 reanalysis and GRACE space gravimetry to estimate the steric and mass components. Two altimetry sea level data sets are considered (from DTU and CLS), based on Envisat waveforms retracking. Regional sea level trends seen in the altimetric map, in particular over the Beaufort Gyre and along the eastern coast of Greenland are of steric origin. However, in terms of regional average, the steric component contributes very little to the observed sea level trend, suggesting a dominant mass contribution in the Arctic region. This is confirmed by GRACE-based ocean mass time series that agree very well with the altimetry-based sea level time series. Direct estimate of the mass component is not possible prior to GRACE. Thus we estimated the mass contribution over the whole altimetry era from the difference between altimetry-based sea level and the ORAP5 steric component. Finally we compared altimetry-based coastal sea level with tide gauge records available along Norwegian, Greenland and Siberian coastlines and investigated whether the Arctic Oscillation that was the main driver of coastal sea level in the Arctic during the past decades still plays a dominant role or if other factors (e.g., of anthropogenic origin) become detectable.